FUTURE WORLD OIL PRICES

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Introduction

This paper summarizes the major findings of an analysis prepared for the Office of Policy and Evaluation, U.S. Department of Energy. The purpose of the study was to delimit a range of world crude oil prices that might occur between now and 1990.[1]

Unlike analyses of most physical systems, analyses of the international energy system are dominated by uncertainty. Two major sources of uncertainty dealt with in this analysis are the future level of OPEC production capacity and future rates of economic growth. Both of these factors affect the balance between supply and demand, hence the price, in the world oil market. In recognition of such uncertainties, the approach taken posits a range of assumptions for each of these factors.

Methodology

The world oil price projections, presented below, were derived from simulations involving four major analysis systems (see Figure 1):

1) The Oil Market Simulation model, which projects world crude oil supply, demand, and prices on a regional basis;

2) The Mid-Term Energy Market model (formerly the Project Independence Evaluation System, or PIES), which simulates domestic energy supply and demand and equilibrium prices for the various types of energy;

3) The International Energy Evaluation System, which is an international counterpart of the Mid-Term Energy Market model; and,

4) The Data Resources (DRI) model of the U.S. economy.

The analysis was initiated by making preliminary estimates of future world oil prices with the Oil Market Simulation (OMS) model. OMS is a reduced form, parametric representation of the world oil market. The model calculates a price of oil that will balance total world supplies with total world demands. These preliminary estimates indicated that even with moderate rates of economic growth, world oil prices might double, or even triple, by 1990.

The initial estimates were preliminary in the sense that they were derived using a calibration of the OMS model which was consistent with world oil price levels of around $15 per barrel. In order to recalibrate elasticities in the OMS model to be consistent with much higher world oil prices, it was necessary to use the other three models to analyze the adjustments of energy supply and demand and economic activity to high oil price levels.

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[1] The views and interpretations expressed in this paper are those of the author and do not necessarily reflect a position of the Department of Energy. For a more complete presentation of this analysis, see (1).

To gain further insight into this problem, it may be useful to follow the adjustments which occur in the OMS model if world oil supply and demand are not in equilibrium. When demand exceeds supply, consumers bid up the price of oil. As a result, the following three adjustments are set in motion:

- An increase in the price of oil encourages an increase in the production of additional oil supplies;
- An increase in the price of oil causes the quantity of oil demanded to decline and the demand for alternative energy forms to increase; and,
- Increases in the price of oil adversely affect the rate of inflation and trade balance in countries dependent on oil imports which reduce their rate of economic growth. This decline in economic activity reduces both their total demand for energy and their demand for oil.

The magnitude and net effect of these adjustments vary not only from one region to another, but according to the magnitude and timing of the price increase. Thus, the Mid-Term Energy Market model and the DRI macroeconomic model were used to analyze the adjustments within the domestic energy system and the domestic economy to alternative world oil price trajectories. The International Energy Evaluation System was employed in a similar fashion to analyze the adjustment of foreign energy systems. These results provided the information necessary to recalibrate the OMS model.

Results

Two ranges of future world oil prices were projected with the OMS model based on two economic growth scenarios. Table 1 shows the range of economic growth rates used to define the optimistic and pessimistic growth scenarios. The optimistic growth rates are consistent with those reported in the Energy Information Administration's (EIA's) Annual Report to Congress (see 2, page 67). The pessimistic growth rates were arbitrarily assumed to be one percentage point lower.

For each economic growth scenario, ranges of world oil prices were determined by constraining the level of OPEC production capacity according to the optimistic and pessimistic estimates shown in Table 2. These estimates are also consistent with data reported in EIA's Annual Report, see (2, page 81), and suggest that development of Saudi Arabia's production potential presents the major uncertainty in this area.

Figure 2 illustrates the range of world oil prices projected for each economic growth scenario. In this figure and throughout this discussion, oil prices are expressed in 1978 dollars per barrel delivered to the East Coast of the United States. The upper end of each price range corresponds to the pessimistic estimate of OPEC capacity, 36.5 million barrels per day in 1990, whereas the lower end corresponds to the more optimistic estimate of 43.5 million barrels per day.

As shown in Table 3, the real price of oil could begin to rise as early as 1982 and reach the $26-37 per barrel by 1990, if the optimistic growth scenario becomes a reality. Realization of the lower economic growth estimates could delay any real price increases until the 1985-1988 period with prices reaching $16-21 per barrel range by 1990.

Conclusion

Based on the findings of this analysis, it is not unlikely the recent leveling off of real oil prices will come to an end in the next decade. Exactly when oil prices could

begin to rise in real terms and to what levels is highly uncertain. It must also be noted that although such increases are likely, they are not inevitable. A number of events, such as extensive energy conservation, accelerated development of new energy sources, or the adoption of aggressive energy policies in the United States and elsewhere could significantl delay another round of escalation in world oil prices. The potential effects of these and other factors are the subject of an ongoing analysis within the Energy Information Administration.

References

(1) Energy Information Administration, An Evaluation of Future World Oil Prices, Analysis Memorandum AM/IA-78-05, June 1978.

(2) Energy Information Administration, Annual Report to Congress, Volume II, DOE/EIA-003612, Washington, D.C., April 1978.

Table 1

Economic Growth Assumptions
(Average Annual Rates)

Country or Region	1975-1985		1985-1990	
	Optimistic	Pessimistic	Optimistic	Pessimistic
United States	4.2	3.2	3.1	2.1
Canada	4.2	3.2	3.1	2.1
Japan	5.6	4.6	5.6	4.6
OECD Europe	3.6	2.6	3.8	2.8
Australia/New Zealand	4.1	3.1	4.5	3.5
Developing Countries	6.6	5.6	6.2	5.2
OPEC	5.5	4.5	4.4	3.4

Table 2

Range of OPEC Production Capacities
(Millions of barrels per day)

Country	1985		1990	
	Optimistic	Pessimistic	Optimistic	Pessimistic
Saudi Arabia	12.0	10.0	17.0	12.0
Kuwait	3.0	3.0	4.3	3.0
United Arab Emirates	3.0	3.0	3.2	2.5
Other Arab OPEC	8.0	8.0	8.3	8.3
Other OPEC	12.8	12.8	10.7	10.7
Total OPEC	38.8	36.8	43.5	36.5

Table 3

Summary of World Oil Price Analysis

Optimistic Growth	Year of Initial Price Increase	World Oil Price[1] 1985	1990
Optimistic Capacity	1982	19.00	26.00
Pessimistic Capacity	1982	21.00	37.00
Pessimistic Growth			
Optimistic Capacity	1988	14.50	16.00
Pessimistic Capacity	1985	15.00	21.00

[1] Prices are stated in 1978 dollars per barrel, C.I.F. East Coast of the United States.

Figure 1

Overview of Analysis Methodology

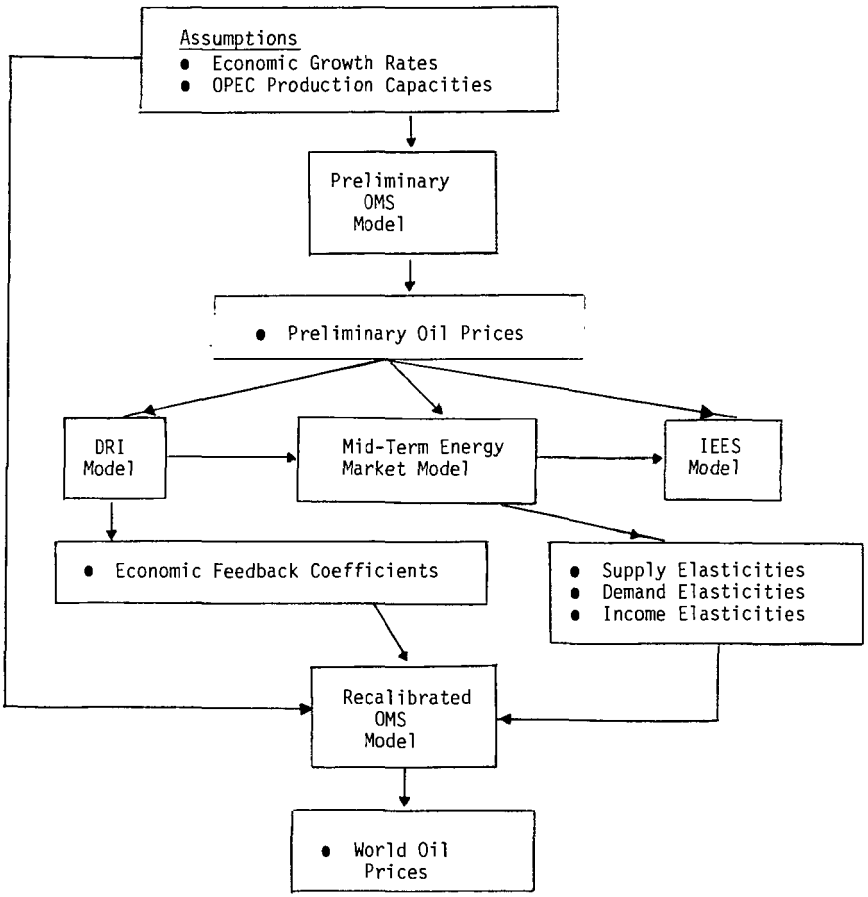

Figure 2

WORLD OIL PRICE PROJECTIONS